Docket No.: 0094.067A

REMARKS

Claims 1-23 were presented in the application as filed. In response to a restriction requirement, claims 1-6 and 23 were withdrawn in the previous response. Therefore, claims 7-22 are currently pending.

Allowable Subject Matter

Claim 20 is objected to as being dependent upon a rejected base claim, but the Office Action states that the claim would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims. This indication of allowable subject matter is gratefully acknowledged.

Claim Rejections Under 35 U.S.C. § 102

Claim 7 is rejected under 35 U.S.C. § 102(e), as being anticipated by Kim (KR 2002040644A; abstract only) on the grounds that Kim teaches crystalline *nano*tubes made by lyophilizing a colloidal dispersion of ferrite (emphasis added). The rejection is traversed.

Initially, Applicants point out that claim 7 requires that *micro*tubes be produced by freeze-drying a dispersion of nanoparticles, and that the reference does not teach this limitation of the claim. Secondly, even if the claimed invention did relate to production of *nano*tubes, Applicants respectfully submit that Kim does not disclose a process wherein nanotubes are produced by freeze-drying. A copy of the EPO Abstract for JP2002220216, one of the members of the patent family that includes KR2002040644A, is attached. This Abstract shows more clearly than the cited Derwent abstract that Kim's freeze drying process produces a ferric oxide and gamma-ferrite basic catalyst having a particle size ranging from 20nm to 80 nm, and there is no indication that the catalyst has a tubular structure. Crystalline multi-walled carbon nanotubes are manufactured from a mixture of carbon monoxide and/or hydrocarbons with hydrogen gas in the presence of the catalyst. However, in order to clarify that the microtubes are composed of an assembly of the nanoparticles, claim 7 is now amended to recite in part "freeze drying the dispersion to produce microtubes comprising an assembly of the nanoparticles." Support for the amendment may be found in claim 1. Kim is silent regarding preparation of tubular structures by assembly of nanoparticles. Since Kim does not disclose production of *micro*tubes, composed of an assembly of nanoparticles, by freeze drying a dispersion of the nanoparticles, Applicants submit that claim 7 is not anticipated by the reference. It is believed that the rejection is hereby overcome.

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Claim Rejections Under 35 U.S.C. § 103

Claims 7-19, 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim in view of Chang *et al.*. (U.S. Patent No. 6,240,293). The Office Action states that Kim fails to teach the oxides, concentrations, pH values, or dispersion diluent claimed (page 3, last paragraph), and that Chang teaches that aluminum, titanium and other ceramic oxides can be made into nanotube fillers, (page 4, first paragraph). The rejection is traversed.

Applicants agree with the Examiner's characterization of the deficiencies of the Kim reference, and add to those the deficiencies discussed in relation to the rejection of claim 7 above, briefly, that Kim fails to disclose microtubes composed of an assembly of nanoparticles. (Claims 8 and 21 are now amended to recite the "microtubes comprising an assembly of the nanoparticles" language as in claim 7.) Regarding the Chang patent, with respect, Applicants submit that the teachings of the reference are mischaracterized in the Office action. Chang teaches nanocomposites composed of a ceramic oxide matrix containing nanotube fillers (Abstract) and that inorganic nanotubes may be prepared from materials such as boron nitride, silicon nitride, silicon carbide, dichalcogenides, for example, WS_2, oxides such as MoO_3, and materials having a composition of $B_xC_yN_z$ (col. 3, lines 14-18). The reference is completely silent regarding *micro*tubes, and does not disclose how to produce *nano*tubes composed of the listed materials. Therefore, since neither reference teaches microtubes, or microtubes composed of assembled nanoparticles, or preparation of a tubular microstructure by a freeze-drying process, Applicants submit that the invention as embodied in claims 7-19, 21 and 22 is not obvious over the combination of the references. It is believed that the rejection is hereby overcome.

Respectfully submitted,

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MULTILAYER CARBON NANO TUBE AND ITS MANUFACTURING METHOD

Patent number: JP2002220216
Publication date: 2002-08-09
Inventor: KIM DON CHORU; PARK CHURU WAN
Applicant: DON UN INTERNATL CO LTD
Classification:
- international: C01B31/02; B01J35/02; B01J37/18; B01J37/32; D01F9/127
- european:
Application number: JP20010356806 20011122
Priority number(s): KR20000070508 20001124

Abstract of **JP2002220216**

PROBLEM TO BE SOLVED: To provide a highly crystalline multiplayer carbon nano tube whose d-spacing, d002 of carbon hexagonal lattice faces of the tube is 0.3400 nm or less for which application development is in progress recently including application for a highly efficient electric conductor and an electron emitter for a plate display and a method for manufacturing the same.
SOLUTION: This method comprises using as a basic catalyst a ferric oxide (&gamma - ferrite) which is manufactured by colloidal dispersion and is freeze-dried and whose average particle diameter is between 20 and 80 nm, reducing it in a reduction atmosphere at 400-700 deg.C, mixing carbon monoxide and/or carbon hydrate as a raw material with hydrogen at a moving phase and/or a stationary phase of the catalyst surface and manufacturing the tube by vapor phase cracking on the surface of the catalyst.